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The effect of mood on attention to global and local characteristics of music

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Abstract

The effect of mood on global and local processing was studied in 60 undergraduate psychology students, half of which were randomly assigned to a positive condition and the other half to a negative condition. Each participant carried out same-different judgements on pairs of melodies that were either the same, or altered globally or locally. Key findings included significant differences in performance for all melodies; however despite a trend for enhanced local processing in a negative mood compared to a positive mood, the effect of mood on global and local processing failed to reach statistical significance. These findings suggest that mood may not have a strong influence on processing in auditory perception.

Ethical Declaration

This experiment was conducted in accordance with the ethical conditions and procedures outlined by the British Psychological Society. Full ethical consent was obtained from the University of Plymouth's Department of Psychology Ethics Committee. In the ethical proposal it was outlined that there would be some minor withholding of information to ensure that participants were not aware of being induced into a certain mood, however this was overcome in debriefing where participants were made fully aware of the nature of this minor deception and why it was essential to the integrity of the research.

Introduction

When faced with stimuli in the environment, there is argument as to whether the whole picture is taken in at once (the view that Gestalt psychologists take), or if attention is drawn to particular details or features. This is known as the global and/or local distinction. The general, abstract features are termed as global structures or characteristics, whereas the more specific, concrete details of a stimulus are termed as local structures or characteristics. Global and local processing is also sometimes referred to as holistic and analytic processing respectively, which refers to either seeing a stimulus as a whole or as its parts. This global versus local processing distinction was first demonstrated by Navon (1977) who presented participants with several tasks that tapped into global and local processing of visual information. Among these, the embedded letters task involved presenting participants with large letters made up of smaller letters, the task being to either recognize solely the large letters or solely the small letters. Navon (1977) discovered that participants were not only faster in response to global structures, but global differences were also more frequently detected. Navon (1977) interpreted these results as a robust tendency to primarily attend to global visual information. Navon (1977) suggested that this global precedence could potentially be explained by the ease of accessibility to global features compared to local features, and this has been supported by Fiske and Taylor (1991) who later classed global attending as the normative strategy of attending.

Since this discovery, many researchers have found that the global and local processing distinction is subject to several experimental conditions and individual factors. An appreciation of these factors has led to greater understanding of in what conditions one type of processing is preferred over the other, and why. In addition, in more recent years researchers have been concerned with whether the global and local processing distinction could be extended directly to modalities other than vision, such as the auditory domain. The objective of the current study was to further explore global and local processing in auditory perception, focusing on how mood influenced this effect.

The main reason for primarily focusing upon the effects of mood on processing in auditory perception was that evidence from within vision indicated mood in particular to be highly influential to one's focus of attention, determining whether global or local aspects of the stimuli were more prominent (Gasper & Clore 2002), and therefore this effect was expected to also apply within auditory perception. How a person feels has been shown to be influential across many cognitive functions such as memory, how we think about the world, perceive other people, and make decisions and

judgements. It is therefore not surprising that it is also strongly influential in how information is processed and what is attended to. Several studies have highlighted mood as having a particularly strong influence on whether a person attends to the global or local features in a visual scene (Gasper & Clore, 2002), and also to what type of information processing that person utilizes (Kitamura, 2005). To demonstrate the latter point, Kitamura (2005) investigated whether mood influenced the type of information processing strategy that was employed, and in particular demonstrated that those in positive moods were more likely to engage in automatic processing as opposed to controlled processing. Taking this into consideration, it is therefore plausible that global and local processing might also differ with mood. In fact, Gasper and Clore (2002) demonstrated that this was indeed the case: happier moods were more associated with a global focus whereas sadder moods were more associated with a local focus, finding this effect robust across two different tasks consisting of reproducing a drawing from memory, or the classification of geometric figures. These results demonstrated the importance of the role of mood in determining what type of processing a person will utilize in particular situations. Furthermore, this finding is consistent with the Cognitive Tuning Theory (Zajonc, 1960), which hypothesizes that a person's mood may modulate the type of information processing strategy that they utilize, and ultimately whether they engage in global or local processing.

Interestingly, it has been discovered that being in a happy mood might actually impair performance in tasks which require attention to detail (Schnall, Jaswal & Rowe, 2008). Schnall, Jaswal and Rowe (2008) induced children between six and eleven years into either a happy or sad mood, and then observed performance in disembedding tasks. In their first experiment, ten to eleven year olds in a happy mood were slower to find embedded figures than those in a sad mood. In a second experiment, it was found that six to seven year olds in a happy mood found fewer embedded figures than those in both the neutral or sad mood (Schnall, Jaswal & Rowe, 2008). This indicated that perhaps a happy mood triggers a more global processing style, which subsequently leads to missing finer details. However, it is important to note that engagement in local processing would only be disadvantageous for tasks involving attention to detail. Further evidence for the effect of mood was revealed in the way of a link between depression and the tendency to engage in local processing (Andrews and Thomson, 2009). It was recently suggested by Andrews and Thomson (2009) that the persistent rumination evident in depression might actually be an adaptive response to the complex social problems often reported by people with depression, known as the analytic rumination hypothesis (Andrews & Thomson, 2009).

Therefore on the basis of evidence presented it is clear that mood is influential to processing, and it appears that a positive mood leads to more global processing whereas a negative mood leads to more local processing, at least within vision (Gasper & Clore, 2002; Schnall, Jaswal & Rowe, 2008). If this were also found to be the case within auditory perception, then this would be compelling evidence to suggest that the global versus local processing distinction holds the potential for application to other modalities.

In reviewing the literature surrounding global and local processing, it is clearly important to address an issue central to the present experiment, concerning the definitions of global and local features in audition. Whilst in vision there are fairly

clean cut and well defined dimensions upon which global and local characteristics are based (usually spatially), it is clear that the boundaries for what constitutes a global or a local characteristic in audition are much less obvious. In fact, several different definitions of the global and local distinction have been mentioned in the literature, such as using harmonic cadences (Tillman, Bigand & Madurell, 1998), contours and intervals (Dowling, 1978), and short periods and long periods (Sanders & Poeppel, 2007). Inevitably this proves somewhat difficult when attempting to compare the results. Dowling (1978) suggested that this problem can be addressed by using “same-different tasks” which best capture the global versus local distinction, in which melodies are modified at the pitch/interval (local) versus the contour (global) level. This is because contours are large units that are made up of smaller units, and therefore a modification to contour (contour-violation) is a global cue. In contrast, modifications to interval/pitch but preserving the contour (contour-preserved) are a local cue.

It is also vital to explore additional factors that have been found to influence processing in vision research, before transferring this knowledge to the auditory domain. Several experimental conditions including familiarity of the stimulus and the presence of cross-modal information have been found influential to global and local processing. In order to illustrate the influence of familiarity on processing, Forster, Liberman and Shapira (2009) found that expecting a novel stimulus enhances global processing whereas expecting a familiar event enhances local processing. It has been suggested that evolutionary adaptive reasons underlie this effect, and for the following reasons: global processing (1) is more abstract and is therefore more likely to include the novel stimulus, and (2) enables quicker identification as there are typically fewer categories on the global level (Forster, Liberman, and Shapira, 2009). This finding could be relevant to the aims of the present study, as on the basis of these results if the melodies are novel to participants this might generate an overall global bias, demonstrating only the influence of novelty rather than the effect of any mood manipulation.

In addition, whilst it has been shown that listening to music has an effect on the processing of visual information, there is relatively little evidence exploring whether visual information affects music processing (i.e. the reverse of the effect). Recently Boltz, Ebendorf and Field (2009) investigated this precise question, focusing on whether visual displays alter the way music is perceived. Participants heard four unfamiliar ambiguous melodies accompanied by visual scenes varying in their affect and format in order to see if the way the music was perceived was affected by the visual information present. Boltz et al. (2009) discovered that merely having visual information accompanying music altered the acoustical parameters of the melodies (Boltz, Ebendorf & Field, 2009) in comparison to melodies without an accompanying visual display. These results indicate that visual information does in some way affect music perception, and therefore may stimulate one type of processing over another. However, further research which investigates whether visual information specifically triggers global or local processing of music would be of greater importance to the present study.

Another factor for consideration in terms of its effect on global and local processing is level of musical training. Research within the auditory domain has demonstrated that most people show a global bias when listening to music (Evers, Dannert,

Rodding, Rotter & Ringelstein, 1999); however Bever and Chiarello's (1974) influential study suggested that this may not be the case for musicians. The results indicated that musicians have a local bias in the processing of musical stimuli, as compared to non-musicians (Bever & Chiarello, 1974). Further evidence for a local bias in vision for musicians comes from both disembedding tasks and constructional tasks which found musicians' performance to be superior to non-musicians (Stoesz, Jakobson, Kilgour & Lewycky, 2007). These results demonstrate that there is something about extensive musical training that enhances local processing of both visual information and musical stimuli.

In Bever and Chiarello's (1974) influential study comparing musicians with non-musicians it was also discovered that the processing of music was predominantly carried out in the left hemisphere for musicians (known as a right ear advantage) compared to non-musicians who showed the opposite effect and processed music primarily in the right ear (left ear advantage). This discovery shaped the notion that the left and right hemispheres might be characterized by differential processing, with the left hemisphere superior at processing local information, and the right hemisphere primarily better at processing global information. Further evidence for hemispheric specialisation comes from Peretz (1990) who gathered evidence from patients with unilateral brain damage. Patients with brain damage to the right hemisphere displayed little sensitivity to contour as a discrimination cue, indicating that damage to the right hemisphere must impair in some way the use of melodic contour as a global cue (Peretz, 1990). Interestingly, evidence from animal lesion research provides evidence consistent to this, demonstrating that gerbils' right auditory cortex primarily used global cues whereas the left auditory cortex primarily used local cues, indicating that perhaps hemispheric specialisation might be an evolutionary precursor (Wetzel, Ohl, & Scheich, 2008). However despite this compelling evidence for hemispheric specialisation and its use in making successful predictions regarding lateralization, the notion has also met with some criticism. In an ERP study by Sanders and Poeppel (2007), the authors found enhanced performance for global over local judgements, however failed to demonstrate hemispheric specialisation. Nevertheless, it may be that Sanders et al.'s (2007) use of temporal aspects might not be the best dimension upon which to define global and local characteristics of music, and therefore this would explain why these results are contradictory to previous findings of hemispheric specialization (Peretz, 1990), which captured the global and local distinction using contours versus intervals/pitch.

Turning to the smaller body of research that addresses the question of whether the global or local processing distinction can be extended to audition, Mottron, Peretz and Menard (2000) used a same-different task in which participants were presented with pairs of melodies which were either transposed, contour-violated, or contour-preserved. Mottron et al. (2000) compared high functioning individuals with autism with normally developed matched controls. Their reason for studying this particular subset of the population was that there are certain clinical indications of atypical auditory processing in autistic individuals, such as hypersensitivity to sound, impaired language but preserved musical abilities, and a high incidence of musical "savants" who show extraordinary musical talents. Interestingly, the autistic individuals performed better than the control group in the detection of local changes; however global performance was the same for both groups (Mottron, Peretz & Menard, 2000). It remained plausible however that participants gained a global

representation of the contour-violated melodies by adding several small-scale units together: a chaining strategy, as suggested by Mottron et al. (2000). Therefore what was interpreted as global processing might have in fact been local processing, by way of this chaining strategy. However, this was presumed unlikely to have occurred as it did not explain the superior detection of contour-violations. Subsequently, these results indicated a local bias in music perception in autism, however they also disputed the theory that the existence of a local bias in autism was accounted for by impairment to global processing, as no such impairment was found (Mottron et al., 2000).

It might also be that manipulation of the instructions rather than manipulation of the material itself could have more of an effect on what type of processing is utilized. Peretz and Morais (1987) used a same-different judgement task in which participants were either asked to respond as quickly as possible, or had no such time pressures. Participants in the experimental condition displayed left hemisphere lateralization for accuracy in judging altered melodies. Peretz and Morais (1987) concluded that time pressures in the condition where participants were instructed to respond quickly enhanced reliance on mainly left hemisphere processing, suggested to be concerned primarily with the processing of local features (Bever & Chiarello, 1974). It could be that because the instructions point out to the participant the most important aspect of the task, this enables them to make an intentional choice as to which type of processing might be required, therefore resulting in enhanced local processing in this case (Peretz & Morais, 1987).

A distinctly different definition of global and local characteristics in audition was used by Tillman, Bigand and Madurell (1998) who drew on the importance of harmonic cadences and their different meanings depending on how they are processed. Participants were required to solve musical puzzles by either joining two sections of music into the most appropriate order (Tillman, Bigand & Madurell, 1998), or rating how complete the music sounded. In half of the minuets they were presented with, the cadence that the first section ended upon was such that it could either mark a temporary ending or a definitive ending depending on whether it was processed globally or locally. Tillman et al. (1998) concluded that local processing of harmonic cadences was more prevalent than global processing.

Further evidence consistent with the existence of a local bias in the music perception is drawn from more recent research by Bigand, Gerard and Molin (2009) which investigated familiarity in music. This involved participants listening to normal or scrambled music and judging whether the music was famous or unknown. In addition to this, Bigand et al. (2009) altered the size of the temporal window in an attempt to assess how long it takes for participants to make this judgement. It was found that the minimum amount of time that it took participants to judge a piece of music as familiar or not was extremely short, indicating that it is local and not global features that are important in music recognition. It seems on the basis of this evidence and that of Tillman, Bigand and Madurell (1998) that local processing is favoured in those circumstances which require finer attention to detail, global cues are lacking, or novel stimuli is involved; however global processing appears to remain the normative strategy. This is consistent with Navon's (1977) and Fiske and Taylor's (1999) interpretation in that an individual attends to the features most accessible to them.

The aims of the current study were to explore the effect of mood on global and local processing of music, and based on previous research both from vision (Gasper & Clore, 2002; Schnall, Jaswal & Rowe, 2008) and from auditory perception (Mottron, Peretz and Menard, 2000), there were two main predictions. Firstly, performance for globally altered melodies would be better than for locally altered melodies. Secondly, performance for locally altered melodies would be enhanced in a negative mood.

To test this hypothesis, the present experiment involved a mood manipulation, and participants undertook a same-different task in which judgements were made on pairs of melodies that were either the same, or differed globally (contour-violated) or locally (contour-preserved). Evidence from the visual domain has provided valuable insight into how the global and local processing distinction works, the possible reasons why it occurs, and the wide range of factors that it is subject to. Necessary application of this knowledge to research in the auditory domain should enable researchers to ascertain whether the effects of mood on global and local processing in vision could be extended and applied to audition. With regards to practical applications, this knowledge might then be applied to educational settings or the workplace, in order to inform strategies for improving attention to detail in certain tasks. Other potential outcomes of the results include a greater understanding of why it is that people experience music differently, and generation of predictions for the conditions under which global and/or local processing might be favoured.

Method

Participants

Participants were 60 Undergraduate Psychology students (54 Female and 6 Male) from the University of Plymouth between the ages of 18 and 45, recruited as part of a course requirement. Half of the participants were randomly assigned to the positive mood condition (28 Female and 2 Male) and the other half to the negative mood condition (26 Female and 4 Male).

Participants were required to have none or very little musical training to take part, in order to control for the possibility of a local bias discovered for individuals with extensive musical training (Bever & Chiarello, 1974). Although the proportion of females was particularly high in this study, no effect for gender has yet been found on processing and as the focus of this particular experiment was on mood, this was not seen to be a factor requiring control.

Materials

Twelve nine-note melodies were written. These were written in a way that corresponded closely with those used in Mottron, Peretz and Menard (2000). These melodies all started and ended on the tonic, and only included diatonic notes, so were tonal in nature. Each note of each melody lasted 350ms in length except the last, which last 700ms. They were generated using Adobe Audition, using a simple 5-harmonic tone.

For each melody, two modifications of the melody were made by altering one note of the melody. The serial positions of these modifications were as follows: one in serial position 2, two in serial position 3, two in serial position 4, two in serial position 5, two

in serial position 6, one in serial position 7, and one in serial position 8. The modifications were contour-violated (B) or contour-preserving (C).

Contour-violated melodies were melodies in which the pitch direction of the intervals surrounding the altered note were altered from the target melody (A). In B, the contours surrounding the altered note change from + + to - +.

Contour-preserved melodies were melodies in which the same note used for the contour-violated change was altered but in a way which did not affect the contour of the melody, as in C.

Across the 24 comparison melodies (the contour-preserved and the contour-violated melodies) the following qualities of the set were preserved: the amount of pitch change in the altered tone across the two types of comparison; the musical interval between the original and the altered tone; the degree to which the altered note was an important or less important scale degree; the average departure from the tonic of the altered tones; and the average size of the two intervals surrounding the pitch changes.

Design and Procedure

The nature of the experiment meant that the design consisted of both between and within subjects, with participants in either a positive or negative mood (between subjects), and each participant making judgements on all target melodies (within subjects).

Participants were verbally briefed as to what the experiment would entail, and also given a printed brief with further information to read. If participants were happy to proceed, they were then asked to sign a consent form, and fill in their age and gender details. Participants were randomly assigned to either a positive or negative mood condition, and were asked to put headphones on and watch a film clip corresponding to the mood inducing condition they were in. The film clip for the positive condition was a scene from *The Jungle Book* and for the negative condition was a scene from *Sophie's Choice*. There were then two practice trials in which participants were presented on the computer with pairs of melodies, and asked to indicate whether the pairs of melodies were the same or different by pressing either an 's' or 'k' key. At the end of the practice trials participants were presented with 36 trials in the same format as the practice trials, and participants' responses were recorded on the computer as hits or misses depending on whether they answered accurately. Participants did not receive feedback regarding whether their responses were correct or not.

Upon completion, participants in the negative mood condition were then asked to watch another film clip (the same scene from *The Jungle Book* used in the positive condition) in order to raise their mood. Researchers then explained the true purpose of the experiment and the reasons for withholding information regarding the mood manipulation involved, and any questions or concerns were answered. In addition, all participants were given a printed debrief to take away with them, with further details of the experiment and contact details of the experimenters.

Results

The means and standard deviations for all experimental conditions are displayed in Table 1.

Table 1
Descriptive Statistics (N=60) including mean score of incorrect answers or “misses” (out of a total possible score of 12) and Standard Deviations.

	Mood	Mean	SD	N
Global miss	Positive	4.67	2.23	30
	Negative	4.57	2.44	30
	Total	4.62	2.32	60
Local miss	Positive	6.90	2.59	30
	Negative	5.93	2.21	30
	Total	6.42	2.44	60
Same miss	Positive	2.50	1.61	30
	Negative	2.67	1.58	30
	Total	2.58	1.59	60

Table 1 indicates that there were fairly large differences among the within conditions (global, local, and same) with best performance (i.e. having the least misses) for unaltered melodies (Same Condition), poorer performance for globally altered melodies (Global Condition), and poorest performance for locally altered melodies (Local Condition). Furthermore, the descriptive statistics show that the effect of mood was relatively small. However, for locally altered melodies there was a slightly larger difference between the Positive and Negative conditions, which might indicate a possible interaction.

A mixed two way ANOVA revealed a significant main effect for target melody (within conditions) $F(1, 58) = 58.17, p < .001$; however the analysis failed to find a significant effect for Mood $F(1, 58) = .65, p = .42$ nor evidence of a significant interaction between target melodies and Mood $F(1, 58) = 1.39, p = .25$. Follow up analysis using LSD pairwise comparisons found that there were significant differences between all target melodies ($p < .001$) indicating that performance was significantly different for Global, Local, and Same melodies.

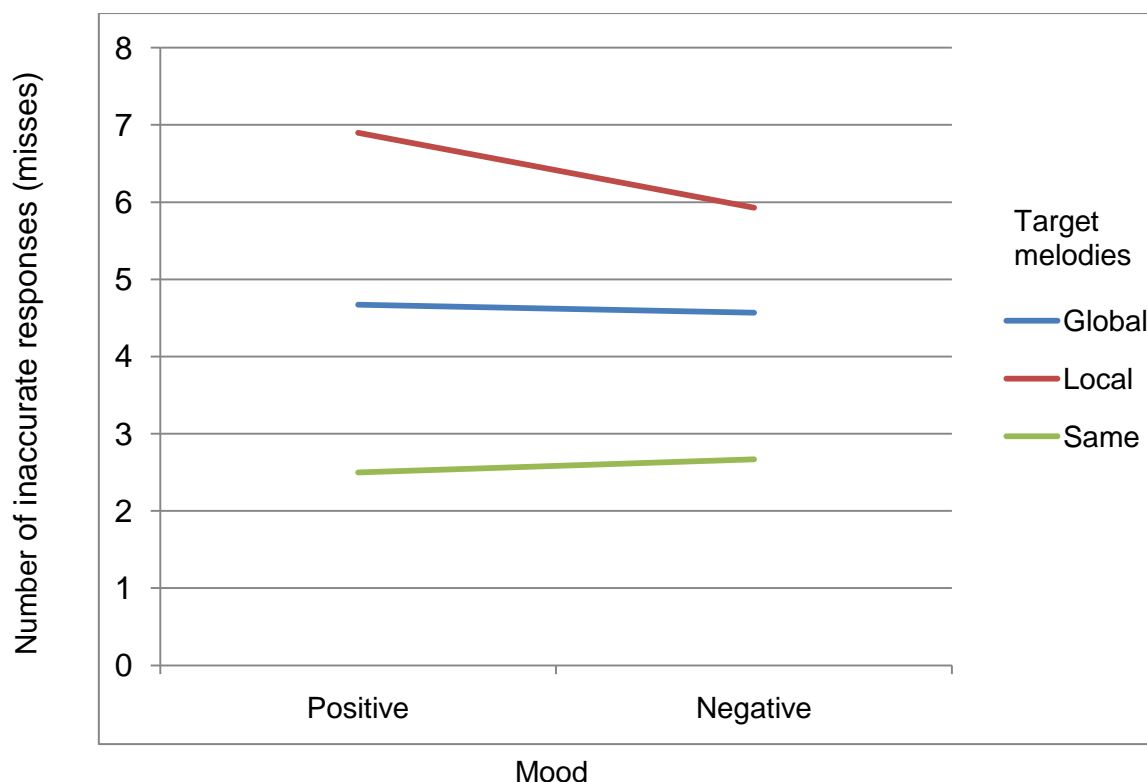


Figure 1 *Plot of mean scores, showing the interaction between target melodies (1= Global, 2= Local, 3= Same) and mood (Positive or Negative), with the lowest scores representing the least inaccurate responses, out of a possible total of 12.*

The relationship between Within (Target melody) and Between (Mood) conditions is illustrated in Figure 1 on the previous page, which indicates that despite not reaching statistical significance, there did seem to be at least some evidence of a trend for participants to perform better for locally altered melodies in the Negative condition compared to in the Positive condition. Figure 1 displays this possible trend well, portraying fairly similar performance across Positive and Negative moods for both Global and Same melodies, but also highlighting a different, sloping trend emerging within Local melodies, indicating improved performance for Local melodies in a Negative mood. However, the slope indicating this was not a steep gradient, and ultimately the statistical analysis deemed this to be an insignificant trend.

Discussion

The results of this study indicate that there was not a statistically significant relationship between mood and global and local processing in music perception. However there is evidence from the mean scores suggesting that there is a potential trend in the negative mood condition for enhanced local processing compared to the positive mood condition; however this performance did not surpass that of global processing. Although not statistically significant, this trend indicates that the relationship between mood and global and local processing is consistent with the experimental hypothesis that local processing will be better when an individual is in a negative mood as compared to a positive mood. Among the melodies, performance for all target melodies was significantly different from each other and in the order expected, which validates the task as it confirms that the global, local, and same melodies were different enough from each other to produce differential processing.

In light of previous research which focused on global and local processing within vision, the results of the present experiment are consistent with Navon's (1977) original research that found a precedence for global structures over local structures. The results show that performance for the globally altered melodies (Dowling, 1978) was better than performance for locally altered melodies, and this was completely independent of what mood manipulation participants were in. As this reflects Navon's (1977) findings regarding visual information, this implies that there is a good possibility that the global or local distinction could also be extended and applied directly to audition, and that the effect might well work in similar ways in both visual and auditory perception. A possible explanation for the prevalence of global processing in the positive mood condition could be that participants wanted to remain in a good mood, and therefore avoided engaging in local processing because this might have disrupted their positive mood.

In terms of the issue of what constitutes a global or a local characteristic and therefore taps into global or local processing in audition, the results of the present experiment go some way to confirming the use of contour versus interval/pitch as effective features, and validate the same-different task which was first proposed by Dowling (1978) to measure differential processing in auditory perception. The significant main effect of contour-violated (global), contour-preserved (local), and same (unaltered) target melodies suggests that this task did result in differential performance across the conditions, and therefore validates the same-different task as measuring what it was intended to. The fact that the interaction between mood and target melodies did not reach statistical significance might have been due to the lack of a transposed condition, which was used by Mottron, Peretz and Menard (2000) in an experiment similar to this and which reached statistical significance. In Mottron et al.'s (2000) design there was a transposed condition in order to gain a second, independent assessment of global processing. It was suggested that the capacity to recognise two transpositions as the same should be more difficult, because whilst each absolute pitch value is altered, the intervals and contour remain the same. It may be then that failing to incorporate a transposed condition into the present experiment resulted in less significant data. Further research which tests this would be beneficial as it would allow more direct comparisons to be drawn from previous research.

In terms of previous research investigating the effects of mood on global and local processing, the results are as expected based on evidence within the visual domain that mood modulates whether a person utilizes global or local processing (Gasper & Clore, 2002; Kitamura, 2005; Schnall, Jaswal and Rowe, 2008). There are many reasons why an effect may not have been found, including confounding factors, sample size, and methodological weaknesses; however it might simply be that mood does not have an effect on global and local processing in auditory perception. Therefore it might be that mood has a greater influence on the processing of visual information than auditory information, and although the global and local processing distinction appears to apply to the auditory domain, it might not apply in exactly the same way. For instance, it could be that processing of auditory information might be more susceptible to factors such as familiarity, rather than mood. However, though the results proved to be statistically insignificant, there is clearly some evidence of a small effect of mood on the performance of local processing in the direction predicted, with better local processing in a negative mood. It could be that with a

larger sample of participants or a greater number of trials, this could have yielded more significant results which would better reflect previous research. It might also be the case that the results of this experiment are not as significant as previous research such as Schnall, Jaswal and Rowe's (2008) study, due to the difference in age groups in the experiments. For example, Schnall et al. (2008) investigated young children between six to eleven years, whereas age was not a primary focus of the present experiment. Therefore it could be that at a younger age processing is more vulnerable to the effects of mood, and therefore future research might look at age along with mood in order to assess whether this is the case.

Another problem underlying comparisons with prior research investigating mood on global and local processing in vision is that as mentioned previously, there are less clear-cut definitions for precisely what constitutes a global or a local characteristic in audition. Many researchers use different dimensions upon which to classify global or local characteristics, such as: contour versus interval/pitch (as used in this experiment); temporal aspects (Sanders & Poeppel, 2007); and also harmonic cadences (Tillman, Bigand & Madurell, 1998). Therefore comparisons to research carried out specifically on the global or local distinction within audition and using contour versus interval/pitch are likely to be more productive and provide greater analysis of the present experiment's results. In particular, the results when compared to Mottron, Peretz and Menard's (2000) study which used a similar method involving the same-different task are at least in some ways very similar. Mottron et al.'s (2000) finding that the clinical group (high functioning autistic individuals) showed a local bias which was not accounted for by impairment to global processing, is in many ways reflected in the present experiment's finding that in a negative mood there was a small local bias, and this was not accounted for by impairment to global processing. Whilst it might be that the clinical group of high functioning autistic individuals and the negative mood condition share some confounding factor that has not been taken into account and is causing this local bias, it is also possible that being in a negative mood activates the same type of processing that is triggered in high functioning autistic individuals. It has already been suggested that there is a tendency to engage in local processing in depression, and therefore it is not outside the realms of possibility that there might be an element present in a negative mood that is also present in autism, and this could be producing the local bias that has been shown.

However, an alternative explanation for the results could be that the small effect seen for negative mood resulting in slightly enhanced local processing might reflect a small proportion of participants having musical training. Although participants were required to have no musical training in order to take part in the study, no explicit measure of musical training was taken and as it is plausible that each person has their own view of what counts as musical training, it may be that a few participants had greater musical knowledge than others. Therefore the enhanced local processing seen in the negative condition might simply reflect a higher proportion of musically trained participants in that condition. However, due to randomisation and the fact that the results only show slightly enhanced local processing which does not surpass performance of global processing, it is assumed that this is not the case. Another potential explanation for the results is that other factors such as familiarity of the material might be having more of an effect on global and local processing than the intended manipulation of mood. Among the previous research reported, the

importance of familiarity of the material presented has seen to be important to whether global or local processing is utilized (Liberman & Shapira, 2009). With this in mind, the results support the theory that there might be evolutionary adaptive reasons for utilizing global processing for novel stimuli and local processing for familiar stimuli. Despite only being correct for half of the time, participants still displayed enhanced performance for globally altered melodies when compared to locally altered or same melodies. This indicates that novelty of the stimuli could be triggering a global processing style, which would result in the superior processing of contour-violated melodies, and impaired detection of contour-preserved melodies, as reflected in the present study's results. Future research might want to examine this further by adding in the level of novelty versus familiarity, and exploring whether this added level has any effect upon global and local processing. If familiar melodies promote local processing, then it would be predicted that there would be a local bias for familiar melodies in both positive and negative moods, although more pronounced for negative mood (on the basis of the trend seen in the present experiment).

Another alternative explanation for the results is found in the way of a chaining strategy which participants might have employed. Suggested in previous research as the building of a global representation by adding several smaller-scale units together as the melody progresses (Mottron, Peretz & Menard, 2000), when contour-violated melodies were judged as the same or different, what was interpreted in the present results as global processing might actually have been chaining strategy. However, although this is a plausible explanation, this strategy would only result in equal performance of global and local processing, and not the superior performance of global processing that is seen in the results. Therefore it is assumed that when participants judged contour-violated melodies as same or different, they were using global cues of contour, whereas in contour-preserved melody judgements, they were engaging in local processing and utilizing local cues of interval and/or pitch.

Although hard to eliminate from experiments such as this, the effects of fatigue also need to be considered as they might potentially confound the results. Participants were repeatedly presented with pairs of melodies, were not given feedback on whether their responses were correct, and also were not told how many trials there would be. Therefore participants' enthusiasm to respond as accurately as possible might have waned and this might have affected what type of processing they utilized. For instance, it could be that the more fatigued an individual is, the more likely they are to resort to the most accessible features and therefore engage in global processing. However, the presence of significant differences between global, local, and same melody pairs indicates that fatigue effects did not have such an effect, as there would have been much fewer differences between these melodies if fatigue effects were present. Furthermore, randomisation of the order of presentation should effectively control for such effects.

With regards to previous ERP findings and of the notion of hemispheric specialisation, although this study did not address brain activity whilst performing same-different music comparison tasks, it would be particularly interesting to record the input of this other dimension in future research. In light of previous findings of Bever and Chiarello (1974) and Peretz (1990) for superior local processing in the left hemisphere and superior global processing in the right hemisphere, the results of the

present experiment would suggest that if brain activation were to be recorded throughout the duration of the same experiment, the right hemisphere should be more activated for positive mood whereas both the left and right hemispheres should be activated for the negative condition, with slightly more activation in the left hemisphere to reflect enhanced performance for contour-preserved (local) melody comparisons.

In terms of strengths and limitations of the present study, there are several weaknesses that may have potentially affected the results and future research should seek to address these. Perhaps most importantly, the melodies used in the same-different task were tonal sequences created solely for the purpose of this study, and therefore they lack ecological validity. This could potentially have a detrimental effect on the results as tonal sequences do not truly reflect the richness of real music and might be too artificial and far removed from real-life to generalise the results to everyday music perception. Future research should consider using real musical extracts, however this could be problematic as the music would be required to differ in only one element and remain the same in all others, and therefore this is why many researchers opt for the more controllable option of tonal sequences.

In addition, the difficulty of the task might prove to be an issue. Even in the contour-violated condition participants on average only responded correctly around half of the time, which leads to the conclusion that the task might have been too difficult and participants might have been guessing the answers. If this was the case, it could potentially explain why no statistically significant interaction between mood and target melodies was found. Added to this, the melodies may have been too long in duration to keep them in mind whilst listening to the next melody, and furthermore the set up of melody-interval-melody might have promoted mental rehearsal, which would be testing memory rather than processing. In order to reduce the level of difficulty of the task, but at the same time ensure that it is not too easy, it is suggested that future research might consider repeating the pairs of melodies so that participants get another chance to hear them and make a more accurate decision. Another suggestion would be to introduce a distracter task in the interval between melodies in order to eliminate rehearsal; however on the basis of the present experiment this would be likely to increase the difficulty of the task, which would not be desirable.

With regards to the film clips used to induce either a positive or negative mood in participants, it could also be postulated that the film used for the negative condition had more of an effect on females than males, as it contained emotional content which was mainly associated with the maternal instinct. However since most of the participants were females anyhow, and this particular film clip has been successfully used in the past, this is not likely to have affected the results in any significant way. Another potential problem with the film clips was that they differed in format, in that the clip used to induce positive mood involved music, whereas the clip used to induce a negative mood did not. In light of previous research that has found that music has an effect on visual perception, and visual information has an effect on music perception, it could be that the presence of this music in the positive condition attuned and primed participants to listening to music before the task. However, as there was the reading of instructions and two practice trials between the film clips and the actual music comparison task, it is unlikely that this had any great effect on

the results, as reflected in the data which revealed no statistical significance for the overall effect of mood.

Another aspect of the study's design which might be considered a limitation was the absence of a neutral mood condition to act as a baseline from which to compare scores from positive and negative mood conditions. However, previous research indicates that the general resting mood state tends to be more on the positive side (Diener & Diener, 1996) and therefore this was not considered to be of importance. In future research it might be interesting to gain participant's ratings of mood, in order to see if different degrees of positive and negative mood show differing degrees of global or local processing. In addition, from the present results it appears clear that global processing is not greatly affected by mood; therefore a greater focus on local processing might prove more beneficial. For instance, various different local melody alterations might bring to light more of an effect of mood on detection of these local changes.

Another imperfection which might prove detrimental to the results is the fact that participants were asked to listen carefully as to whether the melodies were the same or different before they heard the first melody. A potential problem with this instruction is that it points out the aspects of the task that are most salient, and asks participants to actively attend to them. As has been shown in Peretz's (1990) research using a similar same-different task to the present experiment, it could be that the manipulation of the instructions might have more of an effect on global or local processing than the manipulation of the material itself. Therefore it might be that a different instruction which didn't require participants to actively listen to the melodies, and then asked them if they were the same or different, would produce a very different result. Therefore to solve this problem, in the future one might consider incorporating attentive versus background listening into the experiment's design in order to see if this would have an effect on the type of processing a person utilizes. The only foreseeable problem with this is that to devise a condition which promotes background listening might prove difficult, as inevitably participants would know what to look out for as soon as the first same-different judgement was asked of them, and they would subsequently begin to attentively listen.

In conclusion, the finding that mood does not have a significant effect upon global and local processing in auditory perception further extends our understanding of the distinction within the auditory domain, and provides more defined questions upon which further research can focus. Firstly, the results validate the same-different task and confirm that performance is better for globally altered melodies compared to locally altered melodies. Secondly, despite not reaching statistical significance it is clear that a small interaction exists between mood and locally altered melodies, with enhanced performance in a negative mood. What remains to be discovered is a greater understanding of why mood might trigger differential processing styles, under what conditions global and/or local processing is favoured, and whether these conditions feature differently for auditory perception compared to visual perception.

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